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# COMMENTS AND OBSERVATIONS ON THE DRILLING ACTIVITIES PERFORMED BY EPA's TAT CONTRACTOR AND SUBCONTRACTED DRILLER DURING THE PERIOD OF JUNE 23 THROUGH JUNE 27, 1992

PREPARED FOR:

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I. SERIOUS VIOLATIONS OF SOP'S AND EPA GUIDANCE REGARDING INSTALLATION OF GROUNDWATER MONITORING WELLS:

A) MONITORING WELL MW-2 WAS INSTALLED WITHIN THE BOUNDARY OF THE HISTORIC PARK CITY LANDFILL, CONTRARY TO USEPA GUIDANCE.

The most blatant violation of EPA guidance in the drilling of these monitoring wells was the placement of well MW-2 within the boundary of the historic landfill (see Figure 1). USEPA direction is clear - drilling directly through municipal landfills is to be avoided in order to protect underlying groundwater, and for obvious safety considerations; rather, drilling is to be conducted off of the actual landfill and downgradient from it. Prior to drilling, the TAT was advised by the property owner (UPCM) that the location selected for MW-2 was within the former landfill boundary. For whatever reasons, the TAT declined to relocate the well 100 feet to the north, out of the former landfill. After drilling five to ten feet, drill cuttings and split-spoon sample cores showed that the borehole was obviously within the landfill.

At this point, the proper procedure would have been to properly abandon the borehole, move off the landfill, and drill a new borehole in a safer location; however, the TAT persisted with drilling in the landfill. If TAT had adequate training and experience in hydrogeology, they would have anticipated the potential for problems arising from drilling through a landfill, and chosen to drill elsewhere. TAT's lack of experience and refusal to follow USEPA policy, resulted in one of the most serious monitoring well installation calamities possible (described below).

B) THE MONITORING WELL COMPLETIONS ARE INAPPROPRIATE FOR THE HYDROGEOLOGIC CONDITIONS ENCOUNTERED AT THE LANDFILL SITE AND IN ONE CASE (MW-2), HAS RESULTED IN THE POTENTIAL CONTAMINATION OF LOCAL GROUNDWATER BY USEPA.

This is the most egregious violation of sound hydrogeologic practice and may have violated State of Utah regulations for monitoring wells, water wells, or groundwater protection. The drilling of all three monitoring wells showed that the underlying groundwater was a confined or semi-confined aquifer system. In each borehole, the saturated zones were found beneath a thick, apparently continuous aquitard that isolated the landfill materials from underlying groundwater system (see cross-section, Figure 2). In each of the three monitoring wells, the static water level rose to an elevation significantly higher than the level at which water was first encountered.

Borehole MW-1 (upgradient) first encountered this aquitard at 5 feet below ground surface (bgs) and the first groundwater at 16 to 18 feet below the surface (the base of the aquitard). The

borehole was deepened to 25 ft bgs and the well was completed; however, rather than installing 10 feet of screen to 15 ft bgs (near the first water), TAT put in 15 feet of screen, possibly interconnecting several discrete saturated zones. The following day, the water level had risen to only 8 feet bgs, clearly indicating that the underlying groundwater was under pressure.

After ill-advisedly locating well MW-2 within the former landfill (discussed above), drilling commenced. For whatever reason, the TAT did not closely monitor the drill cuttings from the borehole; however, UPCM's hydrogeologist was because of the geology observed at MW-1 and concern about breaching the aquitard underlying the landfill. At 25 ft bgs, a two-foot split spoon core revealed six inches of the aquitard (a reddish-brown clay) in the bottom of the core barrel, clearly showing the top of the aquitard to be at 26.5 ft bgs. The TAT erroneously recorded the top of this unit at 25 ft bgs. Drilling continued (slowly) and water was encountered between 34 and 35 ft bgs. The drilling was halted at 39 ft bgs and well completion activities began.

At this point, serious errors in judgment and perhaps criminal negligence, caused the completion of well MW-2 to be entirely inappropriate, if not illegal. First, 10 feet of screen were placed in the well, bringing the screened section up to 27.5 ft bgs, very close to the top of the aquitard unit. Then, the filter pack was brought up to 26 ft bgs, above the aquitard. The bentonite seal placed on top of the sand was intended to plug the aquitard; however, due to careless geologic logging, it completely missed the aquitard and provides no such seal. The formerly continuous barrier between the landfill materials and groundwater has been breached by the drilling and not repaired during well construction. Water level measurements on subsequent days show clearly that the underlying water is under pressure and has risen up the borehole to exactly 26.5 ft bgs, the top of the aquitard. The underlying groundwater is now flowing up the well under pressure, out through the filter pack along the top of the clay aquitard and into the base of the formerly dry landfill. When this water discharges from the base of the landfill, either as springs or to Silver Creek, it will be contaminated by whatever is in the landfill.

Prior to the installation of well MW-2, the landfill was isolated from the groundwater system. EPA and their TAT contractor have breached this natural compacted clay barrier and are thus solely responsible for the ensuing potential groundwater and surface water contamination.

Clearly, this would not have occurred had the following USEPA procedures been correctly followed:

- first, not drilling within the landfill would have avoided breaching whatever natural, compacted liner might exist beneath it;

- secondly, careful geologic logging would have shown the aquitard unit to be between 26.5 and 33 feet bgs, and hence, no need to screen above 33 ft bgs; and,

- finally, the placement of screen and sand up to the base of the aquitard (33-38 ft bgs) and bentonite within the aquitard (26-33 ft bgs) could have maintained the integrity of the natural barrier between the landfill materials and the underlying groundwater system.

The third well, MW-3, was moved further north at the urging of UPCM. During drilling, construction debris was encountered, but no municipal landfill wastes. This well encountered the same hydrogeology and was similarly misconstructed; however, the results are not as critical. The same aquitard (reddish-brown clay) was encountered in MW-3 at 16.5 ft through 26 ft bgs and water was again encountered beneath it. Instead of completing the well with the screened section at 26 to 34 ft bgs, TAT decided to place 15 feet of screen in this well, 5 feet into the aquitard. Filter pack was again placed in the borehole up to the top of the aquitard (16.5 ft bgs), and the bentonite seal above that, again missing the aquitard and not sealing the borehole. The result of this is again, the upward migration of formerly confined groundwater into the construction debris and eventually out of the filled area to surface water.

Most states require that when drilling into or through confined groundwater systems that every precaution be taken to avoid interconnection of the confined zone with other water bearing zones. EPA's contractor was clearly negligent in this regard; the confined zone is now connected to the surficial system, including local surface water, and will continue to push water into the landfill until either the well is properly abandoned or the hydrostatic pressure is equalized.

Research into the laws of the State of Utah may reveal whether state regulations regarding the drilling and installation of monitoring wells have been violated. If Utah's regulations are similar to Montana's, legal action would be taken. I understand that Utah may have a monitoring well installation licensing system, similar to Montana's; the regulations would make for interesting reading in light of the above problems.

In any event, the serious nature of the well construction disaster described above is at least unprofessional and at worst illegal. I recommend that all of these wells be properly abandoned as soon as possible. It is especially critical that MW-2 be plugged so that it does not continue to flood the landfill.

## II. VIOLATIONS OF SOP'S AND EPA GUIDANCE REGARDING INSTALLATION OF GROUNDWATER MONITORING WELLS THAT MAY AFFECT DATA QUALITY OR SAFETY:

### A) IMPROPER AND INEFFECTIVE DECONTAMINATION OF DRILLING EQUIPMENT PRIOR TO PLACEMENT IN THE BOREHOLE.

On several occasions drilling equipment was placed into the borehole before being adequately decontaminated. Examples of this practice are listed below:

1) Prior to drilling well MW-1, the drill rig and pipe were allegedly decontaminated at "the shop". While this may indeed be the case, it is proper EPA procedure to decontaminate the drilling equipment on-site, in case any dust, fuels or other contaminants may have come into contact with the drill rig enroute to the site. When the pipe was off-loaded from the rig, several rods had visible petroleum contamination (oil or grease) on them. This was brought to the attention of the driller by UPCM, who then sprayed the rods with a high-pressure wash. The petroleum contamination was still not removed.

2) During the drilling of MW-3 (at 15 ft bgs), a different hammer-bit was placed on the drill string. This bit was loaded at the shop into the driller's oil/diesel-soaked pickup bed, driven to the site and never decontaminated prior to placing it in the borehole. TAT apparently wasn't aware that this occurred.

3) Decontamination of the drill pipe included a nonsensical light spraying (and evaporation) of acetone after steam cleaning. The purpose of the acetone rinse is to solubilize organic compounds and remove them from the pipe. By letting the acetone evaporate off the pipe, the contaminants remain. The only result of this ridiculous procedure then, is to contaminate the drill pipe with acetone.

4) An undecontaminated steel tape and weight was repeatedly placed in the well annulus to determine the depth to sand and bentonite during placement of the annular materials. Proper EPA procedure requires that anything entering the borehole be decontaminated prior to and after use in each borehole.

The result of these shortcomings may be that groundwater samples collected from these wells will contain petroleum compounds, acetone or other contaminants. These compounds will then be attributed to the landfill when, in fact, they have originated from improper decontamination of equipment during the well drilling and installation.

B) HANDLING OF WELL COMPLETION MATERIALS (SCREEN & SAND) AND PLACING OF SAND IN CONTAINERS OF UNKNOWN CLEANLINESS.

During the completion of all of the monitoring wells, the screened casing was lowered into the borehole by drilling personnel with dirty, oily hands. Also, the silica sand was handled with bare hands, placed in an undecontaminated hardhat, and poured into an undecontaminated funnel. The correct USEPA procedure is for the personnel to wear latex gloves while handling the casing, sand and anything else that is to be placed in the borehole, and to decontaminate everything that might come into contact with the water to be sampled. Any contaminants on the drilling personnel's hands (e.g. diesel fuel) may now be on the well casing and could be transferred to the groundwater sample. Anything the filter pack contacted may now be in the borehole, and may appear in subsequent sample analyses.

C) THE DRILLING METHOD CHOSEN WAS NOT APPROPRIATE FOR POTENTIALLY CONTAMINATED CUTTINGS AND WATER.

The drilling method chosen for these wells resulted in the driller and anyone within 10 feet of the drill being sprayed with cuttings and water. This could have been a problem had there been any contaminated cuttings (especially within the landfill) or groundwater, and should have been anticipated in the equipment requirements (drilling specifications). The driller rigged up a cone of plastic sheeting to deflect the cuttings but it was not effective once groundwater was encountered. While this shortcoming does not affect the sample quality, it is a serious safety concern.

III. SEVERAL SUBSTANDARD OR SLOPPY PRACTICES WERE OBSERVED THAT PROBABLY DO NOT SERIOUSLY COMPROMISE DATA QUALITY, YET BETRAY AN INDIFFERENT OR CARELESS ATTITUDE REGARDING THE QUALITY OF THE INVESTIGATION.

A) DESIGN SPECIFICATIONS FOR DRILLING EQUIPMENT, BOREHOLE AND WELL COMPLETIONS DO NOT ALLOW FOR A PROPER WELL INSTALLATION NOR A REPRESENTATIVE, SEDIMENT-FREE SAMPLE TO BE COLLECTED.

The specifications for drilling the borehole and for completing the monitoring well do not allow a proper well installation nor a representative groundwater sample to be collected from the completed well. Specific design specification problems include:

1) Drilling specifications called for a 4-inch inside diameter (id) borehole to be drilled and a 2-inch id monitoring well to be installed in the borehole. The schedule 80 PVC casing has an outside diameter (od) of 2.4 inches, which leaves only 0.8 inches on either side of the casing within the borehole. The tremie pipe

used to install the filter pack was 1.05 inches od, which only allows 0.55 inches on the other side of the casing for the filter pack. This is not a thick enough sand filter pack to keep suspended sediment from entering the well from the formation with groundwater. The result is a well that does not clean up during development and has excessive suspended sediment in water samples.

2) Centralizers were not used during well installation to keep the well casing centered in the borehole and assure that filter pack was evenly distributed around the well casing. Also, the filter pack size (10-20 mesh) was too large for the geology and screen size. The result is also excessive sediment in water samples.

3) The drill rig was too small and the bit was not appropriate for the geology encountered. A little research into the geology of the area would have shown that clay is an extensive part of the alluvial geology in the basin. The rig and bit could have been selected to accommodate this; however, significant drilling problems resulted from the use of this particular set up. The most detrimental to well construction was that the drill had to be advanced with an open borehole once the confining clay/silt unit was reached in holes MW-2 and MW-3. Thus, significant caving of the hole occurred prior to and during well installation. The result is the clay/silt formation is in direct contact with the screen, since the filter pack was placed as the formation caved; hence, the well did not clean up and samples will contain excessive suspended sediment derived from the formation clays and silts.

4) During well construction, the outer (4-inch) casing was pulled in 3- to 5-foot lifts, much too great to properly place annular materials. This also has the effect of allowing the formation to cave and contact the screened casing (lower depths) or the blank casing higher up. The result is either formation entering the screen as described above, or an inadequate seal around the blank casing allowing surface water to penetrate. This is a sloppy way to complete a well and results again in water samples full of suspended sediment.

The use of these improper specs and procedures can affect analytical results for those compounds that preferentially adsorb to sediments. The specs and procedures that should have been followed to obtain a properly functioning monitoring well are: a 6-inch borehole should have been drilled for the 2-inch well; centralizers should have been placed on the well casing; the correct sand size (16-40 mesh) should have been used in the filter pack; a drill rig and bit capable of drilling in this geologic setting (larger air rotary), advancing casing to the

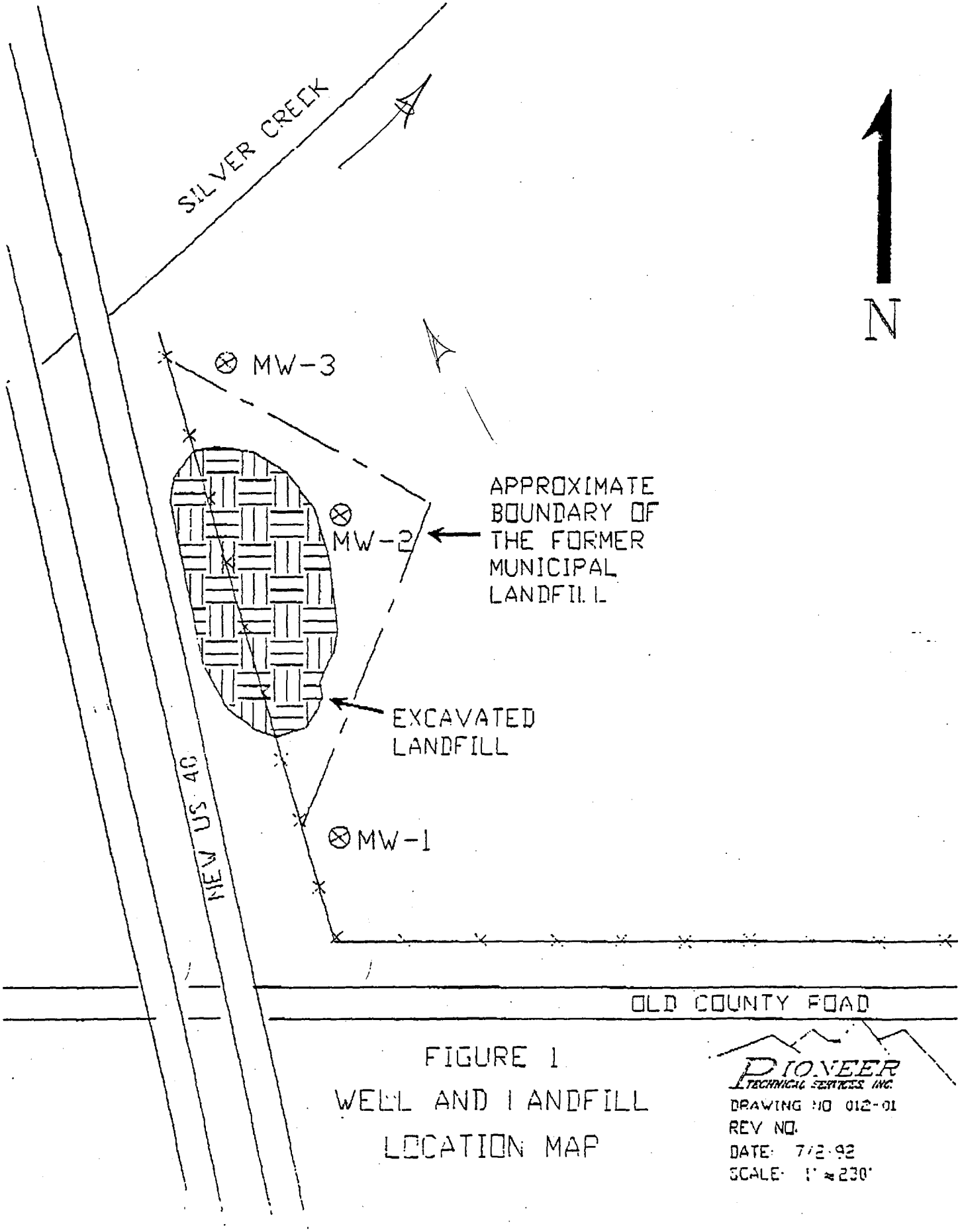
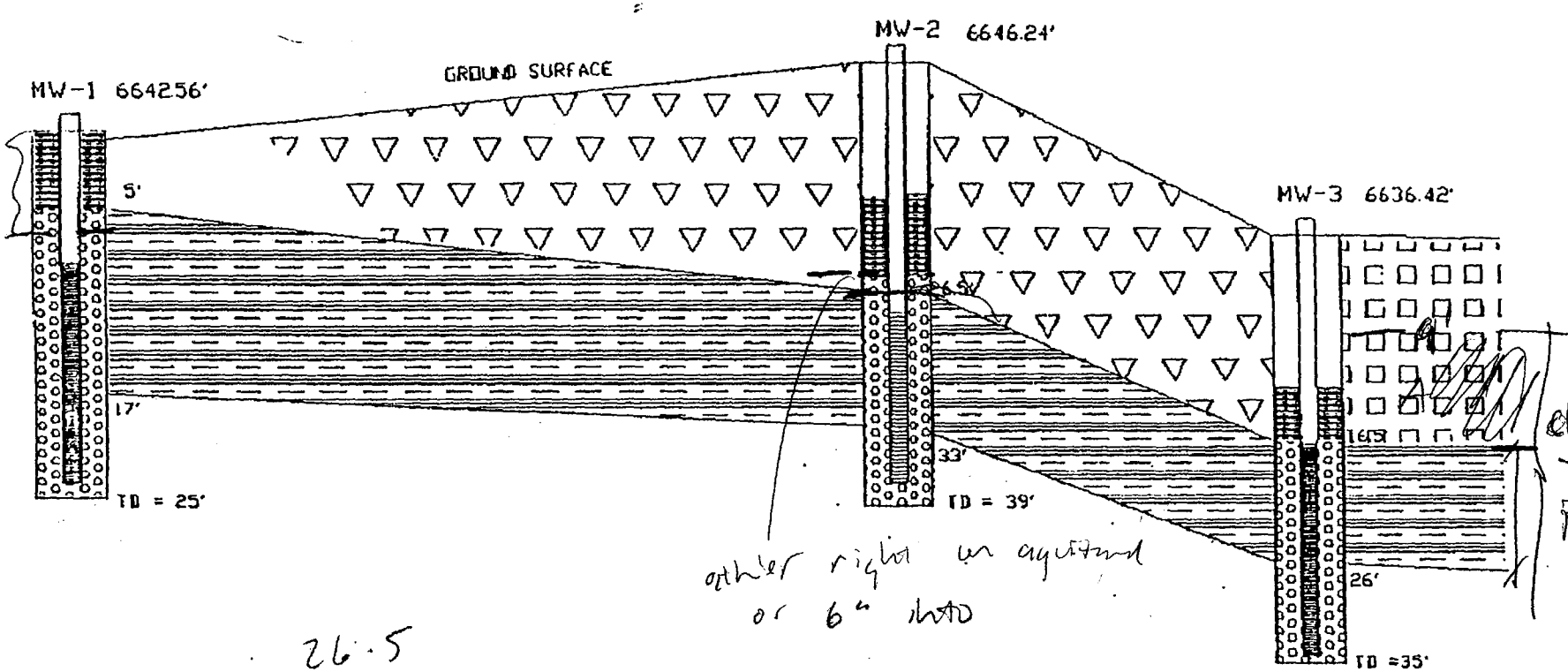



FIGURE 1
WELL AND LANDFILL
LOCATION MAP

PIONEER TECHNICAL SERVICES, INC.
DRAWING NO 012-01
REV NO.
DATE: 7/2-92
SCALE: 1" ≈ 230'




26.5

26.4'

RED-BROWN CLAY

MUNICIPAL LANDFILL DEBRIS

CONSTRUCTION DEBRIS/FILL

CLAYEY SAND OR SANDY/SILTY CLAY

BENTONITE PLUG

SAND PACK

# FIGURE 2
# GEOLOGIC CROSS SECTION AND LANDFILL MONITORING WELLS

PIONEER

DRAWING NO: 012-12
REV NO: A
DATE: 7/13/92
HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 10'